Fishery Technology
2011, Vol. 48(2) pp : 175 - 178

Research Note

Extraction and Composition of Liver Oil from Triggerfish, *Balistes* Spp.

T. K. Thankappan* and K. A Martin Xavier
Central Institute of Fisheries Technology, P.O. Matsyapuri, Cochin - 682 029, India

Numerous species of triggerfish with varied colour patterns are found in and around Indian coastline. Their bright coloured body and rough sandpaper like skin make triggerfish distinctive. In the southwest coast of India, this group of fish are landed in sizable quantity by trawls but fetches very low value (Immanuel *et al.*, 2009). Annual landings of triggerfish in India was 11520 t against the total marine landings of 25 18 305 t (Anon-2007). The fish is edible but has a mild oily taste. The sensory attributes of fish meat are good, but its consumer preference as a food fish is low. At present, there is not much domestic demand for this fish. Fish liver oil is a rich source of poly unsaturated fatty acids and fat soluble vitamins (Kinsella, 1990; Aidos, *et al.*, 2002; Vlieg & Body, 1983; Nair & Gopakumar, 1977). *Odonus niger* and *Sufflamen capistratus*, two species of triggerfish were reported as probable sources of fish liver oil (Immanuel *et al.*, 2002, 2009). Under-utilization of this group of fishes for human consumption in the south west coast of India led to this study on exploring the possibility of extraction and characteristization of liver oil from trigger fish *Balistes* Spp.

Fresh fish of length, 20-25 cm were collected from the catch of a deep sea trawler based at Cochin fisheries harbour. The liver was separated and boiled with equal quantity of water and 1 g sodium carbonate per kg liver weight for one h. The mixture was cooled and the oil was separated. For estimating the fatty acid methyl ester (FAME) lipid was extracted as per the method of Bligh & Dyer (1959). The fatty acid profile was determined by Gas Liquid Chromatography (Varian-Germany) using packed column, 2 m x 1/8 *viz.*, packed with 15% 275, on chromosorb w, flame ionization detector and carrier nitrogen gas and quantified with Sigma standards (Metcalfe *et al.*, 1966). Iodine value, saponification value, and unsaponifiable were determined as per AOCS (2005). The refractive index of oil samples was analysed by Refractometer. The proximate composition *viz.*, moisture, crude protein, lipid and ash content of the fish meat were determined according to AOAC (1990).

The proximate composition of triggerfish meat was determined as 79.7% moisture, 18.6% protein, 0.8% fat and 0.9% minerals. The proportion of different body parts of fish such as head, viscera, frame, skin and flesh was 30.4, 11.2, 20, 5.8 and 32.7 g 100 g^{-1} respectively. The head, viscera, frame and skin constituted nearly 50- 67% of fish which

* Corresponding author; e-mail: tkthankappan@rediffmail.com

is wasted during various stages of processing. By careful utilization of processing wastes like liver, skin and frames, several value added products can be prepared (Gopakumar, 1997). The skin is strong enough to make products like vanity bags, shoes and other leathery goods. Frames can be made into natural calcium.

A comparison of the characteristics of the liver content and liver oil of trigger fish and shark is given in Table 1.

Table 1. Comparison of characteristics of triggerfish and shark liver oil.

Characteristics	Triggerfish liver oil	Shark liver oil
Liver content (%)	7-8	9-10
Liver oil content (%)	65	65-70
Iodine value	105.50	360
Saponification value	215.33	30
Refractive Index	1.4774	1.4913

The triggerfish contains 7-8% liver and 65% liver oil while shark contains 9-10% liver and 65–70% liver oil. Lipids play a vital role in the production of energy and serves as a source of essential fatty acids for normal growth and survival of the fish (Rath, 1993). It was observed that the iodine value of trigger fish oil was low compared to shark liver oil (Table 1). This shows that the oil is more saturated as unsaturated oils give high refractive index. The high refractive index of shark liver oil is due to the high percentage of unsaponifiables.

The fatty acid composition of triggerfish liver oil is compared with that of some marine fishes like sardine and mackerel (Table 2).

Table 2. Fatty acid composition of some marine fish oil (percentage of total fatty acids) in comparison to triggerfish liver oil

Fatty acids	Sardine oil*	Mackerel oil*	Triggerfish liver oil
Saturated (C:12,C:14,C:15,C:16 C:17,C:18)	40.20	37.80	42.62
Monounsaturated (C:16-1, C:18-1)	28.20	27.50	23.84
Polyunsaturated (C:18-2,C:20-3n-6, C:20-5n-6,C:22-6n-3)	29.70	32.30	32.63

* (Gopakumar, 1993)

Fatty acid profile of the oil is the major criterion to accept the quality of the fish oils. Omega-3 fatty acids, including decosahexanoic acid (DHA), originate from phytoplankton and algae and are transferred to fish through the food web. Lovern (1962) observed that the fatty acid composition of fish fat is affected by feeding habbits, sexual maturity and spawning. Trigger fish liver oil contained about 42.62% saturated, 23.84% monounsaturated fatty acid (MUFA) and 32.63% polyunsaturated fatty acid (PUFA). Among the saturated fatty acids C_{14} (myristic acid) is the major component which accounts 17.48% of the total fatty acids followed by C_{18} (stearic acid) and C_{12} (lauric acid). Immanuel *et al.* (2002) reported that *Odonus niger* liver oil extracted by different methods shows 47.05-59.54% saturated fatty acids mainly contributed by the C_{16} (palmitic acid). Similarly, saturated fatty acid C_{16} in *S. capistatus* shows similar trend (Immanuel, *et al.*, 2009). In the present study, C_{16} level of total fatty acid was very low (1.41%).

Mono unsaturated fatty acid in the present study accounts 23.84% of total fatty

acids. The most abundant MUFA detected was palmitoleic acid which constitutes 60% of total mono unsaturated fatty acid followed by 30% oleic acid ($C_{18:1n-9}$). MUFA in *Odonus niger* ranged from 27-31% while *S. capistratus* contained 13-24% of total fatty acid and in both the samples oleic acid was the major component (Immanuel *et al.*, 2002, 2009). Lovern (1962) reported the highest level of MUFA (77.1%) in cod liver oil.

In this study, the PUFA in the FAME was 32.63%. The fatty acid profile of triggerfish shows that the oil is rich in PUFA mainly C_{20} and C_{22} acids. Eicosapentaenoic acid ($C_{20:\ 5n-\ 3}$) and decosahexaenoic acid ($C_{22:\ 6n-3}$) together contributes 73% of total PUFA. Among the C_{18} fatty acid, linoleic acid ($C_{18:2n-6}$) fraction was 2.12% of total fatty acid, while arachidonic acid ($C_{20:\ 4n-6}$), was not detected in the present study. Immanuel *et al.* (2009) reported an average of 18.3% PUFA content in *S. capistratus* liver oil when extracted by different procedures. Among the PUFA, linoleic acid ($C_{18:2n-6}$) was the major fraction. Essential fatty acids like EPA ($C_{20:\ 5n-3}$) and DHA ($C_{22:\ 6n-3}$) levels were low. This result is in agreement with the earlier reports of Immanuel *et al.* (2002) in *O. niger* liver oil.

The present study reveals that the triggerfish is a rich source of liver oil containing EPA and DHA. Processing of triggerfish on industrial level generates substantial quantity of liver, which can be utilized for oil production.

The authors are grateful to the Director, Central Institute of Fisheries Technology Cochin - 682 029 for giving permission to publish this work.

References

Aidos, I., Vander Padt, A., Luter, J. B. and Boom, R. M. (2002) Seasonal changes in crude and lipid composition of herring fillets, byproducts and respective produced oils, *J. Agriculture Food Chem.* **50**, pp 4589-4599

Anon (2007) *Annual Report, 2007, Central Marine Fisheries Research Institute, Cochin*

AOAC (1990) *Official methods of analysis*, 15th edn., Association of Official Analytical Chemists, Arlington, Virginia

AOCS (2005) *Official methods and recommended practices*, 18th edn., American oil Chemist's Society, (William Horwitz., Ed), NewYork

Bligh, E. G. and Dyer, W. J. (1959) A rapid method of total lipid extraction and purification, *Can. J. Biochem. Physiol.* **37**, pp 911-917

Gopakumar, K. (1993) *Indian food fishes biochemical composition*, CIFT publication pp 1-23

Gopakumar, K. (1997) *Tropical fishery products*, Oxford & IBA Publishing Co Pvt.Ltd. New Delhi, pp 233

Immanuel, G., Menenthira, V., Palavesam, A. and Peter Marian, M. (2002) Physico-chemical properties and fatty acid profile of *Odonus niger* liver oil, Indian *J. Fish.* **49**(2), pp 147-153

Immanuel, G., Sathasivan, S., Shankar, V. S., Punitha Peter, M.J. and Palavesam, A. (2009) Processing and characterisation of low cost Balistid fish *Sufflamen capistratus* liver oil for edible purpose, *Food Chemistry*, **115** (2), pp 430-435

Kinsella, J. E. (1990) Sources of omega-3 fatty acids in human diets. In: *Omega-3 fatty acids in health and disease* (Lees, R.S. and Karel, M., Eds) pp, 157-200 Marcel Dekker Inc. New York, *USA*

Lovern, J. A. (1962) Chemistry of fatty acids in fish In: *Fish nutrition* (Heen, E. and Kreuzer, R., Eds), pp 148-150 Fishing News Books Ltd, London

Metcalfe, L.D., Schimitz, A.A. and Petta, J.R. (1966) Rapid preparation of fatty acid esters from lipids for chromatographic analysis, *Analytical. Chem.* **388,** pp 514-515

Nair, R.K.G., and Gopakumar, K. (1977) Fatty acid composition of marine fish body fat, *J. Food Sci. Tech.*, **14**, pp 263-270

Rath, R.K. (1993) Fish feed. In: *Fresh water aquaculture*, pp 234-280, Scientific Publishers, Jodhpur, India

Vlieg, P. and Body, D.R. (1983) Lipid contents and fatty acid composition of some New Zealand freshwater finfish and marine finfish, shellfish and roes, *Lipids*, **12** pp 462-475